

General Disclaimer

One or more of the Following Statements may affect this Document

- This document has been reproduced from the best copy furnished by the organizational source. It is being released in the interest of making available as much information as possible.
- This document may contain data, which exceeds the sheet parameters. It was furnished in this condition by the organizational source and is the best copy available.
- This document may contain tone-on-tone or color graphs, charts and/or pictures, which have been reproduced in black and white.
- This document is paginated as submitted by the original source.
- Portions of this document are not fully legible due to the historical nature of some of the material. However, it is the best reproduction available from the original submission.

E7.5-10309

CR-142910

An Interdisciplinary Analysis of Multispectral
Satellite Data for Selected Cover Types in
the Colorado Mountains, Using Automatic Data
Processing Techniques

EREP S398

Monthly Progress Report for May 1975

NASA Contract NAS 9-13380

*"This available under NASA sponsorship
in the interest of early and wide dis-
semination of Earth Resources Survey
Program information and without liability
for any use made thereof."*

Principal Investigations Management Office
Lyndon B. Johnson Space Center

Technical Monitor: Dr. Rigdon Joosten
Principal Investigations
Management Office
Johnson Space Center
Houston, TX 77058

Principal Investigator: Dr. Roger M. Hoffer

Laboratory for Applications
of Remote Sensing

Purdue University
West Lafayette, IN 47906

(E75-10309) AN INTERDISCIPLINARY ANALYSIS
OF MULTISPECTRAL SATELLITE DATA FOR SELECTED
COVER TYPES IN THE COLORADO MOUNTAINS, USING
AUTOMATIC DATA PROCESSING TECHNIQUES
Monthly Progress Report, May 1975 (Purdue

N75-25256

Unclas
70309

G3/43

MONTHLY PROGRESS REPORT

MAY 1975

A. Overall Status and Progress to Date

All sections of this investigation are now heavily involved in preparation of the final report, both text material and illustrations.

An error in the Band designation of the channels from the NASA 24 channel MSS flown as Mission 247 was discovered in the past month. Sorting of the channels required a re-evaluation of all work accomplished with the Mission 247 MSS data. This error was believed to be caused by poor documentation being sent with the Mission 247 data tapes. The corrected channels are listed in Table 1. After the channel designation problem was resolved, a new classification of Lake Hope area was performed. The delineation of areas of alteration was exceptional.

Also during the past month, training areas were selected that will be used in the final supervised classification (layered classification) of snow cover in the Granite Peaks test area. A comparison is also being made between the thermal band data and the elevation data.

Work continued on the SL-2, S-192 analysis. The entire Granite Peaks test site was classified with 32 training classes developed using the modified clustering technique (February, 1975 Monthly Progress Report). The separability algorithm was used to select the "best" combination of four channels. SKYLAB channels 2, 7, 9, 11 were selected as yielding the highest average separability between the 32 training classes.

The classification was evaluated using two techniques, test fields and area comparisons. Previously selected test fields (October, 1974 Monthly Progress Report) were used to estimate the per point classification accuracy. A summary of the classification accuracy for each Level 2 (U.S.G.S. circular 671) cover type is shown in Table 2. The range in accuracy is from 52.3 to 100.0% with the weighted average being 85.6% correct. Confidence intervals for the accuracy of each Level 2 class are also given in Table 2. Similar results of classification accuracy are shown for each forest cover type in Table 3. At the forest type map level of detail, the classification accuracy ranges from 50.0 to 100.0% with the weighted average being 71.4% correct.

To estimate the classification accuracy on an area by area basis, the area (hectares) classified into each forest cover type was calculated for five of the six 7 1/2 minute quadrangles in the test site (one quadrangle had to be deleted because S-192 data was not available for the quadrangle). These area estimates were then compared to area estimates obtained by planimetering cover type maps of the test site. The

TABLE 1

CHANNEL	WAVELENGTH BAND
24	0.38 - 0.40
12	0.40 - 0.44
1	0.47 - 0.49
13	0.53 - 0.58
2	0.59 - 0.64
14	0.65 - 0.69
3	0.72 - 0.76
15	0.77 - 0.81
4	0.82 - 0.88
16	0.98 - 1.04
23	1.06 - 1.09
11	1.13 - 1.17
5	1.20 - 1.30
17	1.53 - 1.62
6	2.30 - 2.43
18	3.78 - 4.04
7	4.46 - 4.50
19	6.00 - 7.00
8	8.27 - 8.70
20	8.80 - 9.30
9	9.38 - 9.88
21	10.10 - 11.00
10	11.00 - 12.00
22	12.00 - 13.00

TABLE 2

SL-2 S-192

BEST 4 CHANNELS (CH 2,7,9,11)
LEVEL 2 COVER TYPES

	NO. OF SAMPLES	PERCENT CORRECT	95% CONFIDENT	
			LOWER	UPPER
WATER	96	94.8	88.5	98.3
SNOW	112	100.0	96.4	100.0
GRASSLAND	128	52.3	42.0	62.5
DECIDUOUS	368	61.7	56.5	66.5
CONIFEROUS	1696	90.9	89.0	92.0
TOTAL	2400	85.6		

TABLE 3

CLASSIFICATION PERFORMANCE (WEIGHTED AVERAGE) OF SL-2 S-192 DATA
ANALYSIS USING THE BEST 4 CHANNELS (CH 2,7,9,11)
FOREST COVER TYPE MAP

	NUMBER OF POINTS	PERCENT CORRECT	95% CONFIDENT	
			LOWER	UPPER
WATER	96	94.8	88.5	98.3
SNOW	112	100.0	96.4	100.0
GRASSLAND	128	52.3	42.0	62.5
OAK	160	63.7	55.0	71.5
ASPEN	208	54.8	42.4	61.5
P PINE	432	72.9	68.1	76.1
DWF	1008	76.8	73.5	79.1
SF	256	50.0	43.5	56.5
Ave.		71.4		

TABLE 4

COMPARISON OF AREA ESTIMATES (HECTARES) OBTAINED FROM COVER TYPE MAPS (CTM)
AND COMPUTER-AIDED ANALYSIS TECHNIQUES (CAAT)

	EXPOSED	WATER	GRASSLAND	OAK	ASPEN	P PINE	DOUG AND WHITE FIR	SPRUCE FIR AND SNOW
VALLECITO RESERVOIR	CTM 449 CAAT 155	1160 928	1021 232	340 108	2862 1609	774 2553	5368 5740	3496 4146
GRANITE PEAK	CTM 495 CAAT 217	0 31	124 46	15 31	990 1129	0 1006	4131 5198	9716 7813
LUDWIG MTN.	CTM 170 CAAT 665	139 0	2290 1114	3945 4409	1114 1067	5616 6159	2181 1887	15 170
BALDY MTN.	CTM 0 CAAT 186	16 0	542 93	2058 2150	2243 2259	3264 6312	5136 2924	2212 1547
DEVIL MTN.	CTM 15 CAAT 108	0 0	263 93	402 371	1887 1439	2831 4084	8772 8354	1300 1021

COMPARISON OF AREA ESTIMATES (HECTARES) OBTAINED FROM
COVER TYPE MAPS AND COMPUTER-AIDED ANALYSIS TECHNIQUES

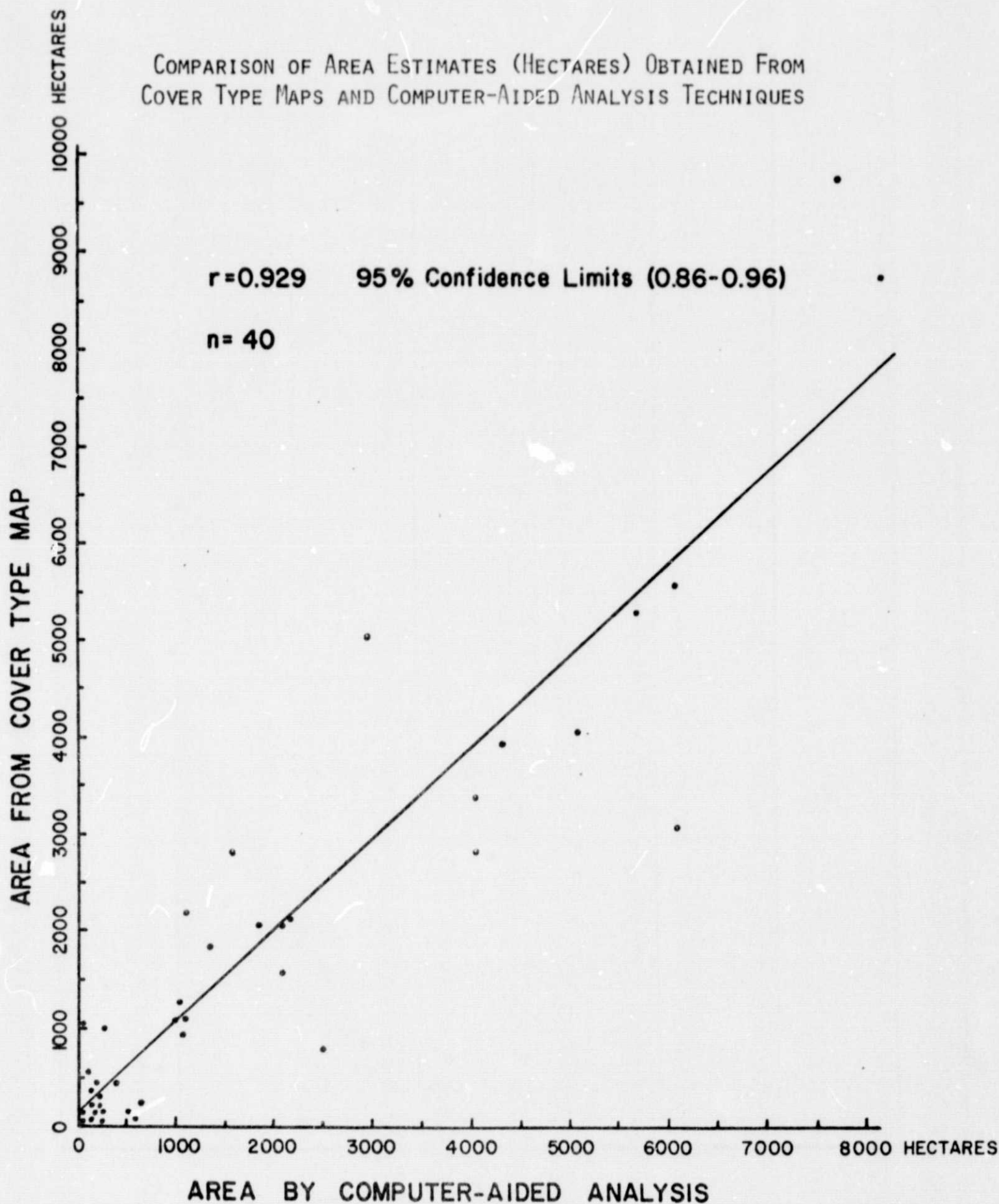


FIGURE 1 6

number of hectares for each class in the forest type map by quadrangle is given in Table 4. To graphically show the relationship between the area from the cover type maps and those from the computer classification, each pair of values were plotted, Figure 1. A linear relationship is indicated by the graph, but to quantify the relationship, the correlation coefficient (r) was calculated using the 40 pairs of values. A high r value of 0.929 resulted from the calculations with a 95% confidence limits of 0.86-0.96. Next, the paired-t test was used to determine if the slope (β) was significantly different from 1 and to determine if the Y intercept (α) was significantly different from 0. At the 95% confidence limits, neither were significant.

In summary, Level 2 cover types can be mapped from S-192 data with an accuracy of 85% while forest map types can be mapped with an accuracy of 70%.

B. Recommendations

None

C. Expected Accomplishments

A rough draft of the text material for the final report will be completed by the end of June.

D. Significant Results

See attached paper entitled "Computer-Aided Identification of a Potential Area of Ore Mineralization in the San Juan Mountains Using 24 Channel MSS Data."

E. Travel Summary

There were no travel funds expended during this reporting period.

Computer-Aided Identification of a Potential Area
of Ore Mineralization in the San Juan Mountains
Using 24 Channel MSS Data

D. W. Levandowski and R. L. Borger

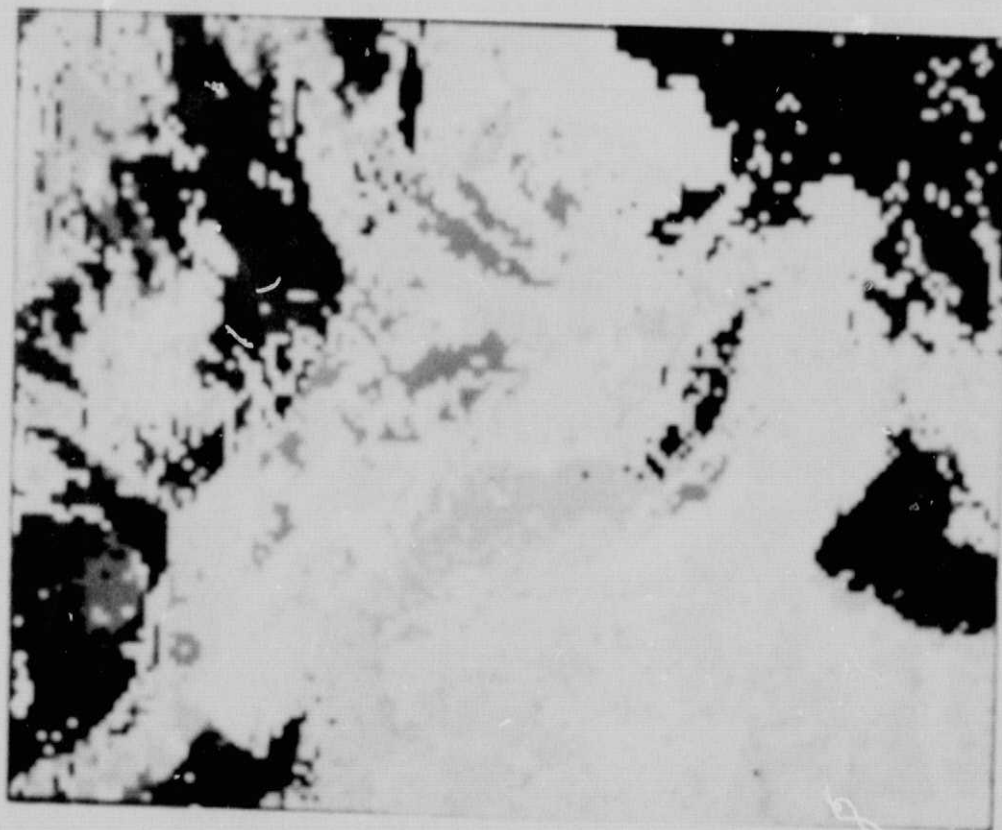
The area near Lake Hope (Fig. 1-A) and San Miguel (Fig. 1-B) on the Ophir and Mt. Wilson Quadrangles was classified using 24 channel MSS data from Mission 247. The Modified CLUSTER Technique* (Fleming, Berkebile and Hoffer, 1975) was used to train the computer for the classification. This technique allowed the area to be classified into 54 spectral cover types. Channels 2, 4 and 12 were used for the clustering and the classification. There were 22 vegetation classes, 4 snow classes, 2 deep shadow classes, 6 mixed rock and vegetation classes, 18 bare classes and 2 altered rock classes. The two altered rock classes represented one sunlit and one shadowed class.

Immediately apparent were the two vein-like areas of alteration (Fig. 1-C) and the hill wash composed primarily of altered rock (Fig. 1-D). These represented the areas of primary interest and were quite well delineated.

Another feature detected by the classification proved to be of somewhat more interest. A small oval patch of shadowed alteration was classified in a location in which alteration had been previously unnoticed during an airphoto study of the area. Area E on Fig. 1 is the lightly shadowed unaltered rock floor of a cirque. Within the cirque is area F, the shadowed altered class.

The air photos taken in conjunction with the MSS were consulted to verify the presence of the alteration. The alteration was present but was so subtle as to remain unnoticed in the previous examinations of the air photos. The alteration is associated with a roughly circular textural and structural pattern in the floor of the cirque. The feature is approximately 400 ft in diameter and is contained within an intrusive body. There are many breccia pipes in the area, particularly to the North and Northeast of here. They are all associated with an intrusive body, are circular to elliptical in cross section and range from 300 to 500 ft in diameter. Many of these breccia pipes have served as the loci for mineralization. This feature should be investigated further to determine if it is also a pipe and, if so, if it is mineralized.

*"Computer-Aided Analysis of LANDSAT-1 MSS Data: A Comparison of Three Approaches, Including 'Modified Clustering' Approach." M. D. Fleming, J. S. Berkebile, and R. M. Hoffer. Proceedings Machine Processing of Remotely Sensed Data. June 1975.



A COMPUTER CLASSIFICATION AND GEOLOGIC INTERPRETATION OF NC-130 MSS DATA, LAKE HOPE, COLO.

